THEORETICAL MODELING OF THERMOPHYSICAL PROPERTIES AND LINE RADIATION SPECTRA OF DENSE IONIZED MATTER

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The need for reliable theoretical data on thermophysical properties of dense ionized matter and detailed simulations of line radiation spectra of various plasma objects stem from a broad range of present-day scientific researches and developments largely dealt with the processes and effects occurring at high energy densities.

To generate such description, one needs to develop a handful of theoretical methods to calculate high-accuracy atomic data and x-ray emission spectra of multielectron ions in hot plasmas, provide realistic representation of dense ionized matter over a wide range of temperatures and densities along with the consistent description of its thermophysical properties (thermodynamical, optical, dielectric, transport, and structural) and fast-ion energy losses.

RFNC – VNIITF efforts in this direction are based on the use of the well-mastered up-to-date models to generate the necessary data on atomic structure and atomic processes, chemical-picture-based model of nonideal plasmas [1, 2], average atom models providing various methods to include ion-ion correlations [3–5], pseudoatom molecular dynamics modeling [6, 7], average-atom collisional-radiative model of non-LTE plasmas [8], and a new version of the line-shape model for multielectron ions allowing for the main line-broadening mechanisms in plasmas

We present a review of theoretical work performed at RFNC – VNIITF in the direction discussed and provide a number of comparisons of the modelled thermophysical properties and line radiation spectra to the experimental and other theoretical data.

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